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## *Symposium*

### Anecdotal Forensics, Phrenology, and Other Abject Lessons from the History of Science

DAVID L. FAIGMAN\*

#### INTRODUCTION

Forensic identification has long been a core component of the criminal justice system. Practitioners of forensic identification typically claim a scientific basis for the technologies and practices they employ in courtrooms everyday. These claims to the mantle of science, however, have varying merit. Some forensic expert opinions, such as in DNA profiling, are based on sophisticated technologies that were developed through rigorous and extensive testing and are limited to statistical statements adequately supported by data. A large number of experts—in such areas as latent fingerprints, firearms identification, handwriting, bitemarks, and many others—have no such sound scientific footings. These experts rely on little more than anecdote and supposition, all generally buttressed by pronouncements from members of insular professional guilds. Given the profound weaknesses associated with these forensic specialties, they are likely to someday largely pass from the scene as has been true of so many other once-believed suppositions masquerading as science, ranging from blood letting to phrenology.

Indeed, the forensic identification sciences that have little or no research basis and depend largely on the subjective judgment of practitioners—“anecdotal forensics”—have much in common with phrenology.<sup>1</sup> In particular, they are failures as science.<sup>2</sup> Yet, neither have

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1. Others have similarly drawn the connection between forensics and phrenology. Professor Jane Campbell Moriarty, for example, observed as follows:

[P]hrenology shares an important trait with forensic individualization evidence: conclusions are not based upon independent testing but upon “scientific observations of countless samples.” Both are experience-based conclusions that rest on the foundation that: (1) the science is valid because of extensive observations; (2) those skilled in the science can do it properly; and (3) the

been complete failures. In the nineteenth century, phrenologists believed that they could describe a person's personality traits and intellectual strengths by measuring the shape of his or her head.<sup>3</sup> Phrenology held sway among many professionals in medicine and psychology and was seemingly based on extensive observation and long experience. Moreover, one of the central tenets of phrenology has been borne out by modern neuroscience. Phrenology was based on the belief that brain function was relatively particularized, thus lending itself to ready identification.<sup>4</sup> It turned out, however, that phrenologists were wrong about everything else. Phrenologists, for instance, were correct that brain function was largely localized, but entirely incorrect that these functions would be manifested by large changes in the brain that were measurable on the skull. Anecdotal forensics are similarly situated today. They are based on extensive observation and long experience, but are likely to be largely incorrect as they are currently practiced. Like phrenology, anecdotal forensics have probably happened upon a few truths, but even these are likely to be inaccurate in the details. One hundred years from now, anecdotal forensics will almost certainly join phrenology and similar notorious beliefs in the annals of abject lessons learned in the history of science.

This Article focuses on the anecdotal forensic sciences. These include areas of forensic identification such as latent fingerprints, firearms, toolmarks, bitemarks, and non-DNA hair comparison, among others. They also encompass certain nonidentification subject areas such as aspects of arson investigation and pathology. An anecdotal forensic science is any specialty area that leads to expert testimony that is based primarily on inductive experience ("experience-based") to develop and test its hypotheses and contains a substantial degree of subjective judgment in its application. Although it is possible to have subject areas that suffer only one of these deficiencies in method—that is, subjectively based but objectively applied or objectively based but subjectively applied—the two together are particularly noxious to truth. This double-

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underlying theory is valid because of the care used by the practitioners.

Jane Campbell Moriarty, *"Misconvictions," Science, and the Ministers of Justice*, 86 NEB. L. REV. 1, 17 (2007); see also Troy Duster, *Selective Arrests, an Ever-Expanding DNA Forensic Database, and the Specter of an Early-Twenty-First-Century Equivalent of Phrenology*, in *DNA AND THE CRIMINAL JUSTICE SYSTEM: THE TECHNOLOGY OF JUSTICE* 315 (David Lazer ed., 2004); Jennifer L. Mnookin, *Scripting Expertise: The History of Handwriting Identification Evidence and the Judicial Construction of Reliability*, 87 VA. L. REV. 1723, 1810 (2001).

2. On the failures of phrenology, see ROBERT M. YOUNG, *MIND, BRAIN AND ADAPTATION IN THE NINETEENTH CENTURY* (1970). On the failures of anecdotal forensics, see Michael J. Saks & David L. Faigman, *Failed Forensics: How Forensic Science Lost Its Way and How It Might Yet Find It*, 4 ANN. REV. L. & SOC. SCI. (forthcoming Aug. 2008).

3. See OXFORD COMPANION TO THE HISTORY OF MODERN SCIENCE 639–41 (J.L. Heilbron ed., 2003).

4. See YOUNG, *supra* note 2, at 23.

barreled subjectivism permits forensic experts wide latitude in practice while rendering the subject areas largely invulnerable to falsification. Simply put, anecdotal forensics are pseudo sciences.

### I. THE ANATOMY OF A FAILED SCIENCE

Although many beliefs in the history of science have come to be understood as having been wrong—including such notables as the convictions that the Earth was flat, that the sun revolved around the Earth, or that good health came from a balance between the bodily liquids (i.e., humors)—phrenology qualifies as the poster child for historical scientific error. In most contexts of failed science, it is unduly critical, even pretentious, to look back through the lens of contemporary knowledge and criticize an earlier time's naiveté. Phrenology, however, is a special case. Its intellectual bankruptcy was apparent early on.<sup>5</sup> Beliefs such as the geocentric view of the universe, for instance, can be readily understood given the context of the times in which they were believed and the limited tools at scientists' disposal to test these beliefs. Since more powerful scientific tests were not readily available, the failures of history can be forgiven. Similarly, the theory of humors has intuitive appeal even today and the subject of disease is sufficiently complex that modern observers feel no sense of empirical superiority when they hear, for instance, that George Washington was bled four times before he finally succumbed to his respiratory ailment—or some combination of his ailment and his therapy.<sup>6</sup> But phrenology is different. Looking back, it seems that phrenologists, and those that came to rely on them, should have known better. The science of the day was more than adequate to demonstrate that phrenology had no basis;<sup>7</sup> but that science was widely ignored.

Phrenology's success in the nineteenth century is largely attributable to its assuming the form of science and its embrace of rationalism. Phrenology was derived from the work of the Viennese physician Franz Joseph Gall.<sup>8</sup> Gall believed that the mind is wholly situated in the brain, that distinct faculties or traits were separately located in the brain, that the size of the brain is a function of the respective strengths of these faculties or traits, and that the surface of the skull provides an accurate index of these characteristics.<sup>9</sup> Gall's hypotheses were originally based

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5. *Id.* at 10.

6. See DAVID L. FAIGMAN, *LABORATORY OF JUSTICE: THE SUPREME COURT'S 200-YEAR STRUGGLE TO INTEGRATE SCIENCE AND THE LAW* 1–5 (2004) (relating the story of George Washington's death).

7. YOUNG, *supra* note 2, at 10 (noting 1840s reference to phrenology as “that sinkhole of human folly and prating coxcombr’y”).

8. See FRANZ JOSEPH GALL, *THE ANATOMY AND PHYSIOLOGY OF THE NERVOUS SYSTEM IN GENERAL, AND OF THE BRAIN IN PARTICULAR* (1796).

9. YOUNG, *supra* note 2, at 12.

and tested on his family members and friends. He eventually developed an elaborate chart of the head that he believed associated certain behavioral characteristics with the shape and size of a person's head. Phrenology was thus largely objectively described, in that practitioners were ostensibly obligated to follow the schemata of the chart to make statements about the person.

Gall's elaborate description of brain function, however, had only a thin patina of research behind it. Indeed, his evidence was primarily anecdotal.<sup>10</sup> Moreover, despite attracting disciples such as Johann Christoph Spurzheim, who conducted anatomical studies to test Gall's theories, phrenology never garnered widespread acceptance in the mainstream scientific community.<sup>11</sup> Ironically, for present purposes at least, Spurzheim's most important proselyte was George Combe, a prominent lawyer in Edinburgh.<sup>12</sup> Combe authored numerous books popularizing phrenology, including the best selling *The Constitution of Man*.<sup>13</sup> Combe too produced a disciple, Hewett Cottrell Watson, who studied phrenology with Combe, because the subject was not taught at Edinburgh University.<sup>14</sup> Watson wrote *Statistics of Phrenology*, a title whose scientific pretensions were matched by its intellectual dishonesty.<sup>15</sup> The book contained no statistics, instead offering little more than a commemorative to phrenology's supposed accomplishments.

Although phrenology and its predecessor physiognomy never gained a toehold in mainstream science, it resonated in the forensic community. In criminal cases, head, face and body shapes had two principal possible uses, the first concerned identifying past criminals and the second aspired to predict future ones. The first was in the modern fashion, and was primarily associated with Alphonse Bertillon's system of cataloguing bodily characteristics for purposes of identification.<sup>16</sup> Bertillon, in effect, sought to develop a kind of "body-print," an identification system that would rival the developing field of fingerprints.<sup>17</sup> As Professor Simon Cole explained, "Bertillon envisioned nothing less than the complete

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10. OXFORD COMPANION TO THE HISTORY OF MODERN SCIENCE, *supra* note 3, at 639-40 ("[Although Gall] initiated studies on the correlation between structures and functions . . . his evidence was anecdotal.").

11. *Id.* at 640.

12. *Id.*

13. GEORGE COMBE, *THE CONSTITUTION OF MAN IN RELATION TO THE NATURAL LAWS* (Cassell & Co. 1893) (1828); *see also* OXFORD COMPANION TO THE HISTORY OF MODERN SCIENCE, *supra* note 3, at 639-40.

14. *Id.*

15. HEWETT C. WATSON, *STATISTICS OF PHRENOLOGY: BEING A SKETCH OF THE PROGRESS AND PRESENT STATE OF THAT SCIENCE IN THE BRITISH ISLANDS*. (1836); *see also* OXFORD COMPANION TO THE HISTORY OF MODERN SCIENCE, *supra* note 3, at 639-40.

16. *See* SIMON A. COLE, *SUSPECT IDENTITIES: A HISTORY OF FINGERPRINTING AND CRIMINAL IDENTIFICATION* 32 (2001).

17. *Id.*

reduction of human identity to a language of notations which could be organized and accessed at will.”<sup>18</sup> But in nineteenth century practice, mapping the body and head also had a more profound potential use, borne of phrenology, that of detecting criminal types.<sup>19</sup> Throughout the late nineteenth century, the typing of every kind of physical trait was widely in vogue, often veering back and forth between identifying those who had previously committed crimes and attempting to predict those who would do so in the future.<sup>20</sup> Whatever the purpose, however, the scientific basis for such practices lay in experience and anecdote. In time, both Gall’s phrenology and Bertillon’s anthropometric system faded as their respective limitations became increasingly obvious. In the case of anthropometry, fingerprinting would prove a more efficient competitor.<sup>21</sup>

Modern anecdotal forensics are similar to phrenology in a variety of disturbing ways. Foremost, perhaps, anecdotal forensic scientists do not, and have not, tested their hypotheses in any serious manner.<sup>22</sup> They look only for confirmations of their practices and rationalize or ignore contradictory evidence. Experience is the *leitmotif* of their methodology. Indeed, some anecdotal forensic experts have their own phrenological chart, the method known as ACE-V, an ostensibly objective method with a large subjective component that allows considerable latitude in practice.<sup>23</sup> The acronym stands for Analysis, Comparison, Evaluation, and Verification.<sup>24</sup> ACE-V began with latent fingerprint examiners and has been increasingly adopted by other identification sciences.<sup>25</sup>

Consider the example of latent fingerprint identification, once the gold standard of forensics. The ACE-V method is the backbone of latent print identification, and the cogency of the entire enterprise pretty much depends on it. In the first step, analysis, the examiner looks at the quality and quantity of detail that is present, often aided by magnification of

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18. *Id.* at 49.

19. *Id.* at 57 (“To criminal anthropologists, the distinction between *using* the criminal body as a link to a criminal record and simply reading criminality directly from the body was not entirely clear.”).

20. *Id.* at 32–59.

21. *See id.* at 140–43 (describing the case of Will/William West and how fingerprint identification proved to be a superior system of identification).

22. *See* Saks & Faigman, *supra* note 2.

23. *See* Moriarty, *supra* note 1, at 17–18 (“The circular reasoning problem, however, is far more easy to spot in the case of phrenology than it is with other forms of forensic individualization, as evidenced by a 2005 Supreme Judicial Court of Massachusetts decision noting the ACE-V method for comparing fingerprints ‘defies easy testing because it does not require a minimum number of similarities, but rather operates on a subjective sliding scale.’ That is to say, ‘I know a match when I see one.’” (internal citations omitted)).

24. David A. Stoney, *Scientific Status*, in 4 MODERN SCIENTIFIC EVIDENCE: THE LAW AND SCIENCE OF EXPERT TESTIMONY § 32:33 (David L. Faigman et al. eds., 2007–2008 ed.) [hereinafter MODERN SCIENTIFIC EVIDENCE].

25. *See, e.g.*, United States v. Mahone, 453 F.3d 68, 71–73 (1st Cir. 2006) (applying ACE-V to footwear impressions); United States v. Allen, 207 F. Supp. 2d 856, 862 (N.D. Ind. 2002) (same).

some sort.<sup>26</sup> The court in *United States v. Mitchell*<sup>27</sup> helpfully summarized the general understanding of the levels of detail considered by examiners at the analysis stage:

[There are] three levels of increasing detail, designated as Level 1, Level 2, and Level 3. Level 1 detail is visible with the naked eye; it is the familiar pattern of loops, arches, and whorls. Level 2 detail involves “ridge characteristics”—the patterns of islands, dots, and forks formed by the ridges as they begin and end and join and divide. The points where ridges terminate or bifurcate are often referred to as “Galton points,” whose eponym, Sir Francis Galton, first developed a taxonomy for these points. . . . Level 3 detail focuses on microscopic variations in the ridges themselves, such as the slight meanders of the ridges (the “ridge path”) and the locations of sweat pores.<sup>28</sup>

The next step calls upon the examiner to compare the trace evidence to a candidate source.<sup>29</sup> This is accomplished by eyeballing the sample and suspect source materials side by side. At the evaluation step, the examiner forms an opinion regarding “individualization,” that is, whether the trace evidence could only have come from the candidate source. Finally, the last step involves the reexamination by a second examiner of the trace and reputed source material to verify the match (or exclusion).<sup>30</sup>

Each step of the ACE-V process is imbued with subjectivity. Although there are general standards associated with the analysis stage—such as clarity of the print and quantity and level of detail—these are merely illustrative for the “well educated and experienced” examiner. The comparison stage is similarly ill defined, since what is required to establish correspondence between the trace evidence and the suspected source is not known and never specified. Heaped on top of the subjectivity of the analysis and comparison steps is the most openly subjective stage, that of evaluation. As Dr. David Stoney has described this step, it is “a ‘leap of faith,’” whereby the examiner decides whether “it is inconceivable that the fingerprint could have come from another person’s finger.”<sup>31</sup> No minimum number of corresponding characteristics are specified in the method and there are no frequency statistics associated with any one or any set of identifying characteristics used in these analyses. Finally, the verification stage simply involves another examiner reviewing the first examiner’s work with full knowledge of the

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26. Stoney, *supra* note 24, at 350.

27. 365 F.3d 215 (3d Cir. 2004).

28. *Id.* at 221.

29. Stoney, *supra* note 24, at 362–64.

30. *Id.* at 353; *see also* 1 PAUL C. GIANNELLI & EDWARD J. IMWINKELRIED, SCIENTIFIC EVIDENCE 897 (4th ed. 2007) (discussing fingerprint identification methods).

31. Stoney, *supra* note 24, at 354.

first examiner's opinion.<sup>32</sup>

The absence of any true research basis for anecdotal forensics does not necessarily mean that they are completely without merit. The difficulty lies in specifying what merit they possess. As was true with phrenology and other failed sciences, aspects of anecdotal forensics are likely to prove true, at least in part. Even leeches have found a resurgence in modern medicine, though thankfully they are no longer prescribed for respiratory ailments.<sup>33</sup> The failure of anecdotal forensics to test their hypotheses might suggest that courts should exclude this evidence altogether until such time when solid research has been done. This, however, is likely to take a very long time. Courts will have to do something in the interim, since anecdotal forensics play such a large role in contemporary criminal trials. Courts must identify some principled middle ground for determining whether, and how extensively, anecdotal forensic experts should be allowed to testify.

The primary concern of this Article is not the scientific bankruptcy of anecdotal forensics, though it is the abiding theme that drives the analysis. The failures of forensics is a subject ultimately too large for the current project and one that has been well demonstrated elsewhere.<sup>34</sup> Instead, this Article considers two peripheral questions that arise given the extraordinary influence anecdotal forensics have achieved in criminal cases. First, how did this happen and, second, what should be done about it? These two issues are related, since any solution proposed must account for the circumstances that led to the problem in the first place. Section two examines why the fundamental failure of anecdotal forensics has been so slow to be realized by those in the law. Section three asks, given this realization, how should courts handle this evidence until such time in the distant future when anecdotal forensics will be relegated to their proper place in the dustbin of history.

## II. WHY HAVE THE FAILURES OF ANECDOTAL FORENSICS ESCAPED THE LAW'S NOTICE?

From the perspective of the average lawyer or judge, the crisis confronting anecdotal forensics lies largely below the horizon. Why should this be so? Anecdotal forensic scientists, of course, would argue that it is unrecognized because the crisis does not exist. But their livelihoods depend on the continued acceptance of anecdotal forensics, so their bare assertions regarding its efficacy, without more, can hardly

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32. See, e.g., *United States v. Mahone*, 453 F.3d 68, 72–73 (1st Cir. 2006) (“There is no evidence that ACE-V mandates blinded verification. Under cross-examination by Mahone’s trial counsel, [the witness] acknowledged only ‘a lot of debate’ over whether a verifying examiner should be blinded.”).

33. FAIGMAN, *supra* note 6, at 9.

34. See Saks & Faigman, *supra* note 2; 4–5 MODERN SCIENTIFIC EVIDENCE, *supra* note 24 (two treatise volumes devoted to the subject of forensic science).



count as authoritative. Although academic scientists have devoted too little time to the subject, they invariably are deeply chagrined when they scrutinize the fields of anecdotal forensics at all closely.<sup>35</sup> In fact, there is almost certainly no world class scientist who has, or would be willing to, stake his or her reputation on the validity of anecdotal forensics. But if anecdotal forensics is so fundamentally flawed, why hasn't this been widely proclaimed, and revealed by an avalanche of erroneous identifications? A wide assortment of reasons helps explain the persistence of anecdotal forensics.

As an historical matter, many failed sciences have held sway for a very long time, often with little evidence to support them and sometimes with abundant evidence to doubt them. History is replete with examples of flawed beliefs that had remarkable staying power. Phrenology, as discussed in the previous section, was actively believed and practiced throughout the nineteenth century.<sup>36</sup> Many learned and influential people believed in the geocentric theory of the universe long after considerable evidence disproved it. A surprising number of people today believe that humans did not evolve from lower forms of life, possibly including even the forty-third President of the United States.<sup>37</sup> Bleeding as a therapy for general physical ailments continued for centuries. In the forensics area itself, certain technologies have been abandoned that had been practiced for decades, including paraffin testing,<sup>38</sup> aspects of arson investigation,<sup>39</sup> and, most recently, comparative bullet-lead analysis.<sup>40</sup> Clearly, the fact that a belief or technology has survived the test of time does not guarantee that it could survive rigorous scientific tests.

Contributing to the basic failure of the adversarial process to uncover the profound flaws in anecdotal forensics is the lack of an independent group of scientists doing work on forensic topics.<sup>41</sup> This has two impacts. On the one hand, it means that there is no one providing

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35. See, e.g., Donald Kennedy, *Forensic Science: Oxymoron?*, 302 SCIENCE 1625, 1625 (2003) ("It's not that fingerprint analysis is unreliable. The problem, rather, is that its reliability is unverified either by statistical models of fingerprint variation or by consistent data on error rates."); David M. Siegel et al., *The Reliability of Latent Print Individualization: Brief of Amici Curiae submitted on Behalf of Scientists and Scholars by the New England Innocence Project*, Commonwealth v. Patterson, 42 CRIM. L. BULL. 21 (2006); Sandy L. Zabell, *Fingerprint Evidence*, 13 J.L. & POL'Y 143, 170 (2005).

36. See OXFORD COMPANION TO THE HISTORY OF MODERN SCIENCE, *supra* note 3.

37. Elisabeth Bumiller, *Bush Remarks Roil Debate over Teaching of Evolution*, N.Y. TIMES, Aug. 3, 2005, at A14.

38. See generally Mary E. Cowan & Patricia L. Purdon, *A Study of the "Paraffin Test,"* 12 J. FORENSIC SCIS. 19 (1967).

39. See John J. Lentini, *Fires, Arsons, and Explosions*, in 5 MODERN SCIENTIFIC EVIDENCE, *supra* note 24, § 38:21.

40. John Solomon, *A Murder Conviction Torn Apart by a Bullet; In a 1995 Maryland Case, Key Testimony and the Science Behind It Have Been Discredited*, WASH. POST, Nov. 19, 2007, at A1 (describing the downfall of the discredited science of bullet-lead comparisons).

41. See Saks & Faigman, *supra* note 2.

quality empirical testing demonstrating the accuracy of anecdotal forensics. On the other, there is no one demonstrating their infirmities, either.

Forensic scientists are mainly not scientists at all, at least in the conventional sense of the term. They do not posit and test theories and hypotheses or investigate natural or social phenomena in order to better understand them. They are technicians. Following simplistic routines, albeit with considerable subjective judgment thrown in, they apply technologies that have themselves never been subjected to rigorous or extensive validity testing. Most have no graduate training in research methods and statistics. A survey of forensic scientists revealed that 1% had Ph.D. level research degrees and about 3% had earned a masters degree.<sup>42</sup> Therefore, even if forensic scientists agreed that their hypotheses were in need of testing, they generally do not have the training or background to do it. Moreover, forensic scientists are very busy in their day jobs. They do not have the time or resources to do original empirical research even if they had the capability or inclination to do so. The level of scientific work needed in forensics can only come from the mainstream academic community.

Forensic issues are rarely considered by academic scientists of any kind. Statisticians, the most likely group to be engaged by forensics, have largely ignored the subject, though they regularly investigate parallel problems, such as signal-detection theory.<sup>43</sup> There are two basic impediments to academic scientists' actively and broadly pursuing research on forensic issues. The first is lack of money, and the second is lack of theoretical relevance. Research often follows the available funding. Historically, there has been little government financing available for basic forensic science research. Agencies such as the National Science Foundation and the National Institutes of Health do not include forensics as part of their mission statements. Probably the single agency most devoted to funding forensic research is the National Institute of Justice (NIJ), an arm of the U.S. Department of Justice. Thus far, NIJ has not been successful in funding cutting-edge research.<sup>44</sup> This

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42. Kenneth G. Furton et al., *What Educational Background Do Crime Laboratory Directors Require from Applicants?*, 44 J. FORENSIC SCIS. 128, 130 (1999).

43. In short, signal detection theory is concerned with the quantification of the uncertainty surrounding the task of distinguishing signal and noise. See generally Victoria L. Phillips et al., *The Application of Signal Detection Theory to Decision-Making in Forensic Science*, 46 J. FORENSIC SCIS. 294 (2001); John A. Swets, *The Relative Operating Characteristic in Psychology*, 182 SCIENCE 900 (1973).

44. Indeed, there is some evidence that indicates that the Justice Department has actively sought to thwart research efforts. See Robert Epstein, *Fingerprints Meet Daubert: The Myth of Fingerprint "Science" Is Revealed*, 75 S. CAL. L. REV. 605, 627-28 n.122 (2002) (claiming to have "internal documents of the NIJ" stating that the Institute delayed a research solicitation at the behest of the FBI until after a *Daubert* challenge had been heard in the Third Circuit); Paul C. Giannelli, *Wrongful*

may, at least in part, be a function of the fact that academic scientists have not considered forensics to be within their domain.

Clearly, before academic scientists can be expected to reform forensic science, they must be convinced that the subject is relevant and important to their respective disciplines. But even brief reflection suggests that forensics could provide a treasure trove of research possibilities. Statisticians, in particular, would find a surplus of hypotheses to test in areas such as latent fingerprints, firearms identification, and handwriting analysis. Indeed, conventional statistical subjects such as pattern recognition and signal detection theory could be tested and applied to forensic problems. Moreover, many scientists would find forensics to be a fertile area to test general theories from their disciplines. The work of Itiel Dror and colleagues—psychologists interested in studying cognitive bias—is a particularly good illustration of this.<sup>45</sup> The list matching forensic subjects to established academic departments is limited only by one's scientific imagination. Forensics, however, are not to be found in most universities and the explanation seems to lie in historical fortuity.

Much of the divide between academic and forensic scientists can be traced to historical circumstances. In nineteenth century America, science was as likely to be found outside the university as it was to be found inside it. The university itself did not become fully formed in the United States until the twentieth century.<sup>46</sup> It was not unusual for serious science to be explored by wealthy amateurs. Benjamin Franklin and Thomas Jefferson are archetypes of this model. But, over time, science became institutionally based. By the mid-twentieth century, most science was done by professionals associated with universities. These university departments housed communities of scientists, set professional standards, and educated succeeding generations of researchers. The anecdotal forensic sciences, however, went a separate way. They became an integrated component of the police apparatus.<sup>47</sup> They became an instrument of law enforcement, largely controlled by police technicians and their superiors. Innovation, such as it existed, was done by nonscientifically trained bureaucrats. Whereas the scientific ideal promotes constant questioning, the bureaucratic inclination is the reverse. Forensic identification embraced the bureaucratic ideal of

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*Convictions and Forensic Science: The Need to Regulate Crime Labs*, 86 N.C. L. REV. 163, 207–08 (2007) (describing allegations that officials at the U.S. Justice Department interfered with research efforts on two separate occasions).

45. See *infra* note 54 and accompanying text.

46. See generally FREDERICK RUDOLPH, *THE AMERICAN COLLEGE AND UNIVERSITY: A HISTORY* (2d ed. 1990); JOHN R. THELIN, *A HISTORY OF AMERICAN HIGHER EDUCATION* (2004).

47. Cf. Giannelli, *supra* note 44, at 221–22.

perpetuating the status quo.<sup>48</sup> Substantial questioning, testing, rethinking, and innovation in handwriting or toolmark identification, for instance, would mean that those trained in the old ways would be in danger of becoming obsolete.

It can be readily assumed that anecdotal forensic experts believe in what they do. The malady in forensics is not fraud, it is indifference. In fact, anecdotal forensics may be particularly susceptible to confirmation bias. One very significant problem is that anecdotal technicians receive imperfect feedback, since ground truth is very often unknown. A defendant's conviction or plea agreement can provide some information, certainly, but the former has a not insubstantial error rate and the latter may not always be a good indicator of forensic accuracy. In fact, a guilty verdict may not demonstrate the accuracy of a particular anecdotal forensic identification at all. The main reason for this is that forensic examiners do not make identifications in a vacuum.<sup>49</sup> They almost invariably know the other evidence in the case. If the suspect was found with blood on his shirt, a gun with the same caliber as the murder weapon, and was sexually involved with the victim's wife, it is exceedingly unlikely that a firearms identification expert would fail to find a "match" between the suspect's weapon and the markings on the shell casings recovered at the scene. At the very least, any ambiguities found would be resolved in favor of a match. As a practical matter, therefore, the information forensic examiners employ to make an identification is not simply a comparison of a forensic sample to a known exemplar, it includes all of the other information known to the police at the time. This is one reason, among many, why defendants do not have a long list of erroneous identifications.<sup>50</sup> Forensic experts can be right most of the time even if their tests are almost completely useless.

Most forensic examiners, in fact, would probably have a high actual

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48. Although there has yet to be an extensive study of the forensic bureaucracy, there is little reason to believe that it operates differently than other self-perpetuating institutions that have been the subject of research. See generally JAMES Q. WILSON, *BUREAUCRACY: WHAT GOVERNMENT AGENCIES DO AND WHY THEY DO IT* (1989).

49. D. Michael Risinger et al., *The Daubert/Kumho Implications of Observer Effects in Forensic Science: Hidden Problems of Expectation and Suggestion*, 90 CAL. L. REV. 1, 13-15 (2002).

50. Courts often point to this fact to support admission. See, e.g., *United States v. Llera Plaza*, 188 F. Supp. 2d 549, 566 (E.D. Pa. 2002) ("It has been open to defense counsel to present examples of erroneous identifications attributable to FBI examiners, and no such examples have been forthcoming."). In *United States v. Havvard*, 117 F. Supp. 2d 848 (S.D. Ind. 2000), the court used this argument, but in a particularly obtuse way: "The government points out correctly that if anyone were to come across a case in which two different fingers had identical fingerprints, that news would flash around the legal world at the speed of light. It has not happened in 100 years." *Id.* at 854. The issue in these cases, of course, is not whether "two different fingers [might have] identical fingerprints," but whether a latent print might be mistakenly identified as matching a known print. This has occurred many times. See Simon A. Cole, *More Than Zero: Accounting for Error in Latent Fingerprint Identification*, 95 J. CRIM. L. & CRIMINOLOGY 985, 1027-28 (2005).

“hit” rate if this statistic were ever measured. But they are working from a population with a very high base rate. The truly relevant issue involves how much information, if any, the forensic identification adds to the other evidence available. Because anecdotal forensic technicians have not studied their subject quantitatively, this figure is unknown. But it should surprise no one if common experience indicates an exceedingly low error rate for anecdotal forensic experts. They are playing with a loaded deck. If the base rate of guilt for those arrested is 80% (and it could be considerably higher), having a perceived success rate that is very high—however this might be defined by practitioners of these dark arts—is not very difficult. This is especially so if no one is actually counting.<sup>51</sup>

Much of the discriminating value of anecdotal forensics probably comes during the investigation phase of the criminal justice process. For example, if the firing pin of the weapon used in a killing was round, as indicated by the mark it left on the cartridge casing found at the scene, a gun with a square firing pin could not have been the murder weapon unless it had been substantially altered. Similarly, if a latent print almost certainly came from the perpetrator, a suspect might be excluded if none of his or her ten fingerprints match it. These cases, of course, never reach the courtroom, but the value of such exculpatory use should not be discounted. Many anecdotal forensics, however, are so subjectively manipulable, that they cannot even be used for exclusion. For instance, handwriting identification analysts cannot exclude a handwriting sample that does not resemble the suspect’s writing, since the person might have disguised it in the unknown writing or when completing the known exemplars. If considerable evidence exists to show that the accused committed the crime in question, handwriting identification will never exculpate him or her. Similarly, the task of excluding a suspect as the person who left a particular unidentified latent print is a challenging task. It requires comparing every part of every finger to ensure that the person conclusively did not leave the print.<sup>52</sup>

Because forensic scientists routinely have knowledge of the other evidence in the case, they are inevitably vulnerable to being affected by cognitive bias. It is a well known phenomenon in psychology that people tend to see what they expect to see. For example, consider, hypothetically of course, that four FBI fingerprint examiners are given a set of twenty “likely matches” (generated by a computer database fingerprint identification system) for a latent fingerprint left on evidence

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51. See Zabell, *supra* note 35 (“The argument that no latent print has ever been found to match the rolled print of a different person is . . . misleading because no systematic search for such pairs on the entire databank of millions of fingerprints has ever been performed.”).

52. Stoney, *supra* note 24, at 356–57.

found at the scene of a terrorist bombing.<sup>53</sup> If one of the “suspects” were a Muslim convert with military training in explosives, knowledge of this information might very well lead an examiner, or even all four examiners, to declare a match when, in fact, it was not a match. There is certainly no reason to believe that forensic examiners could escape such cognitive bias when it affects everyone else. Indeed, research by Itiel Dror and colleagues appears to confirm not only that this bias exists in latent print examinations, but that it is quite robust.<sup>54</sup> Most disturbing, however, is that latent print examination, the supposed gold standard of forensics, would seem to have relatively less room for cognitive biases to intrude in identification judgments. If cognitive bias is a significant problem in latent print identification, it almost certainly is an even worse problem in the less well-developed areas of forensics.

An additional reason forensic experts are prone to confirmation bias is that their approach to the subject is rarely challenged adequately when they testify. This is so for two reasons—lawyers and judges. Most lawyers are not well trained in research methods or statistics. With criminal defense lawyers, and especially public defenders, this lack of training is aggravated by overwhelming case loads. Even if they were so inclined, and had the basic knowledge to do so, public defenders have insufficient time to fully prepare against the well-traveled prosecution expert. Criminal defense lawyers also have few resources to hire experts of their own. And even if they did have such resources, most forensic experts learned their trade working with the police, and may not be generally available for defense work.

Compounding lawyers’ failure to adequately challenge anecdotal forensic experts is the stunning failure of judges to provide any sort of check on this evidence. Although it appears that judges have learned enough science to gate-keep in civil cases, where plaintiffs are often turned away at the inception of the suit, they have not shown the same fortitude on the criminal side of the docket when prosecutors proffer bad science.<sup>55</sup> Judges, on the whole, seem to know enough science to exclude

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53. This hypothetical, of course, is based on the Brandon Mayfield case, in which an Oregon attorney was mistakenly identified as being involved in the 2004 Madrid terrorist bombing. See Cole, *supra* note 50, at 1016. Four FBI examiners confirmed the identification of his fingerprint. See U.S. DEP’T OF JUSTICE, OFFICE OF THE INSPECTOR GEN., A REVIEW OF THE FBI’S HANDLING OF THE BRANDON MAYFIELD CASE (2006), available at [http://www.usdoj.gov/oig/special/s0601/PDF\\_list.htm](http://www.usdoj.gov/oig/special/s0601/PDF_list.htm).

54. Itiel E. Dror et al., *Contextual Information Renders Experts Vulnerable to Making Erroneous Identifications*, 156 FORENSIC SCI. INT’L 74, 77 (2006) (“Our study shows that it is possible to alter identification decisions on the same fingerprint, solely by presenting it in a different context.”); see also Itiel E. Dror & Robert Rosenthal, *Meta-Analytically Quantifying the Reliability and Biasability of Forensic Experts*, 53 J. FORENSIC SCIS. (forthcoming July 2008), available at <http://users.ecs.soton.ac.uk/id/JFS%20expert%20reliability%20and%20biasability.pdf>; Itiel E. Dror & D. Charlton, *Why Experts Make Errors*, 56 J. FORENSIC IDENTIFICATION 600 (2006).

55. D. Michael Risinger, *Navigating Expert Reliability: Are Criminal Standards of Certainty Being Left on the Dock?*, 64 ALB. L. REV. 99, 99 (2000).

complex scientific evidence that is based on flawed toxicology, epidemiology and multiple regression analysis. How is it possible that a judge who recognized the methodological or statistical weaknesses in a mass toxic tort case could be blind to the gross methodological failures of anecdotal forensics? The problem inherent in the courts is not simply ignorance—though there may be plenty of that too—but a fundamental lack of will.

The courts' failure of will is likely associated with two basic fears. The first is fear of embarrassment and the second is fear of the consequences. Anecdotal forensics, such as latent fingerprints, firearms identification and handwriting, are such longstanding staples of criminal prosecutions that their exclusion will inevitably lead to publicity and even ridicule. When a Maryland state trial judge excluded latent fingerprint identification in October 2007, she became the subject of a series of articles in the local paper.<sup>56</sup> Judges, especially elected state judges, do not ordinarily seek out notoriety. This may be particularly so when the subject is not squarely within the judge's area of expertise, such as science. It is even more so when the subject is latent fingerprints, which enjoys such popular approbation that excluding this evidence might make the presiding judge appear unbalanced. In *United States v. Havvard*,<sup>57</sup> for example, the trial court agreed to hold a hearing on the validity of latent fingerprint identification despite the fact that it believed its "decision may strike some as comparable to a breathless announcement that the sky is blue and the sun rose in the east yesterday."<sup>58</sup> And to be sure, questioning the fact that the sun revolves around the earth is not good for anyone's career, whether it was Galileo or, apparently, the trial judge in *Havvard*.

The second fear judges confront when considering the prospect of excluding anecdotal forensics is the potential collapse of criminal prosecutions. From the judiciary's perspective, the wholesale implosion of forensics could cause a crisis in the criminal justice system at several levels. Foremost, it would weaken ongoing prosecutions.<sup>59</sup> This might mean fewer convictions or, of possibly greater concern, fewer plea agreements. The perceived power of forensic identification evidence, such as latent fingerprints and firearms identification, almost certainly

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56. See Jennifer McMenamin, *Judge Bars Use of Fingerprints in Murder Trial*, BALT. SUN, Oct. 23, 2007, at 1A; Jennifer McMenamin, *Science, Tradition at War in Forensics: Fingerprints Ruling Rolls Mainstream*, BALT. SUN, Oct. 29, 2007, at 1A.

57. 117 F. Supp. 2d 848 (S.D. Ind. 2000).

58. *Id.* at 849.

59. See Joseph L. Peterson et al., *The Uses and Effects of Forensic Science in the Adjudication of Felony Cases*, 32 J. FORENSIC SCIS. 1730, 1748 (1987) (reporting a survey indicating that "[a]bout one quarter of the citizens who had served on juries which were presented with scientific evidence believed that had such evidence been absent, they would have changed their verdicts—from guilty to not guilty").

contributes to many defendants' decisions to avoid trial. Blanket exclusion of such evidence would weaken prosecutors' cases considerably. Beyond the current criminal docket, there exists a brooding mass of already decided cases at various stages of appellate or habeas review. Broad recognition of the inherent weakness of anecdotal forensics might lead to a rush to the courthouse.

Wholesale exclusion of anecdotal forensics, therefore, is not a solution likely to be embraced any time soon by the courts. In *United States v. Green*,<sup>60</sup> Judge Nancy Gertner made extensive factual findings supporting her conclusion that the basis for firearms identification was unacceptable and could not support the proffered expert testimony, much less support the toolmark expert's claim that he could identify the suspect weapon "to the exclusion of all others in the world."<sup>61</sup> Yet she also recognized the political reality confronting her if she were to exclude this evidence in its entirety. In explaining her decision to admit the toolmark examiner's testimony in part,<sup>62</sup> she observed as follows:

I reluctantly come to the above conclusion because of my confidence that any other decision will be rejected by appellate courts, in light of precedents across the country, regardless of the finding I have made. While I recognize that the *Daubert-Kumho* standard does not require illusory perfection of a television show (CSI this wasn't), when liberty hangs in the balance—and, in the case of the defendants facing the death penalty, life itself—the standard should be higher than were met in this case, and than have been imposed across the country. The more courts admit this type of toolmark evidence without requiring documentation, proficiency testing, or evidence of reliability, the more sloppy practices will endure; we should require more.<sup>63</sup>

If the political reality is largely as Judge Gertner describes it in *Green*, the question is what to do about it. One could rail against the injustice and stupidity of any admission of such fatally flawed science, but tilting at windmills does have its costs in mental health. There may, however, be a middle ground, one that will permit the continued introduction of anecdotal forensics in some form, but which will both cause the least amount of injury and be most likely to lead to systemic reform. The next section explores this middle ground.

### III. WHAT IS TO BE DONE WITH ANECDOTAL FORENSICS?

Although much of forensic identification science is failed science, it

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60. 405 F. Supp. 2d 104 (D. Mass. 2005).

61. *Id.* at 114.

62. Although Judge Gertner admitted the toolmark expert, she limited the expert to describing similarities between the known and unknown marks and did not allow the expert to testify that the marks "matched." See *id.* at 124; *infra* notes 64–76 and accompanying text (discussing further the merits of Judge Gertner's solution).

63. *Green*, 405 F. Supp. 2d at 109.



might still have something to offer the law. It just might not be very much. Foremost, of course, anecdotal forensics can play an enormous role in investigations. Together with other evidence such as apparent motives and statements by witnesses and suspects, the marks left by fingers, feet, teeth, firing pins, tools, and so forth can help complete the picture of what happened and who did it. The more information contained in this sort of evidence, the better the resolution of the picture. Pristine imprints of three fingers found on the handle of a gun that was left by the side of the victim will provide important evidence for police. But even quite fragmentary evidence might help exclude certain prime suspects and thus contribute to solving the case.<sup>64</sup> Although well-funded research programs dedicated to forensics would likely improve this investigative function considerably, the current state of the art can certainly be useful during the investigation phase.

Yet forensic experts offer to answer a wide range of questions that courts need answered. Does the fingerprint fragment found at the crime scene “match” one of the defendant’s fingers? Do the marks left in the soft metal of a bomb “match” a tool in the possession of the defendant? Do the markings on a cartridge casing “match” those that are left on other casings by the firing pin of the defendant’s handgun? Forensic experts offer opinions about these and sundry other matters every day. And they have been doing it for a very long time. Yet there is no developed science of pattern identification; there are few universities with forensics departments and there appear to be none doing systematic work on forensic identification.<sup>65</sup> If anecdotal forensics offers no objective basis for individualization, that is, conclusively opining that the trace matches the specimen which ties to the defendant, how are courts to respond to such proffers of certainty by these putative experts?

Trial courts, of course, are supremely practical institutions. They must decide concrete cases in a timely fashion. They do not have the luxury of decrying the lack of rigorous research and academically railing against the failed state of forensic science. First of all, there are thousands, if not tens of thousands, of cases in which forensic evidence was a key component of a successful prosecution. Judicial recognition of the uncertain basis for forensics would cast a shadow over these

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64. See Stoney, *supra* note 24, at 356–57 (describing the practical difficulty of determining definitively that a particular person did not leave a particular latent print).

65. It would be worthwhile to conduct an extensive survey of forensic graduate programs in the United States. I would hypothesize that few programs offer sophisticated training in research methods and statistics—given how little of this sort of research is done—and that most programs are designed to train practicing professionals, not professional research scientists. The only arguable exception is George Washington University, which has various iterations of Masters programs, but does not offer the Ph.D. See George Washington University, Department of Forensic Sciences, Overview of Forensic Sciences Programs, <http://www.gwu.edu/~forensic/program.htm> (last visited Apr. 20, 2008).

decisions. Second, there are thousands of ongoing cases that involve one or another forensic identification technique. The success of these prosecutions might depend on the continued allowance of forensic expert opinion. Third, juries have likely come to expect that forensic evidence will be available to buttress prosecutors' cases. Wholesale exclusion of identification forensics would undermine general perceptions of prosecutors' cases. Fourth, although forensic identification expertise may not be perfect, indeed might not even be particularly accurate, it must be better than nothing. Years of experience must demonstrate at least some value to this expertise, thus supporting its continued use until something better comes along.

Courts generally seem to be unaware of the pending crisis in forensic science. Although cracks have appeared along the way—with a few judges willing to challenge the prevailing orthodoxy of uncritical acceptance of anecdotal forensic expert testimony<sup>66</sup>—most courts continue blithely admitting these putative experts and their testimony today just as it was admitted one hundred years ago. Indeed, many of the basic technologies have changed little over those years. Some courts actually believe that the fact this technology has been employed largely unchanged for the past century is a mark in its favor.<sup>67</sup> Certainly, it contributes to the general belief that experience validates forensic practice. Ironically, however, the same courts who point to this long experience also believe that progress will be made as a matter of course. But if the technology has largely gone unchanged for the past one hundred years, the next hundred years are likely to look pretty much the same, unless something happens. Why, after all, should anyone expect modern technicians to step up and innovate now? Maintaining the status quo will have just one effect: it will maintain the status quo.

Clearly, current practice must change, but change will be long in coming. This section considers what should be done in the meantime. Specifically, is there an approach that is both principled and likely to promote the revolution in forensics research that is needed? Courts need to identify a middle ground, one that permits anecdotal expertise that arguably has value, but which limits its reach. Courts should have to explain why they believe that such experience-based testimony will assist the trier of fact.

Federal Rule of Evidence 702 permits "scientific, technical, or other specialized knowledge" and specifically provides that an expert can be "qualified as an expert by knowledge, skill, experience, training, or

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66. See, e.g., *United States v. Fujii*, 152 F. Supp. 2d 939 (N.D. Ill. 2000) (excluding handwriting expertise entirely); *United States v. Hines*, 55 F. Supp. 2d 62, 70–71 (D. Mass. 1999) (not allowing handwriting expert to testify to identity).

67. See *United States v. Havvard*, 117 F. Supp. 2d 848, 852 (S.D. Ind. 2000).

education.”<sup>68</sup> The Advisory Committee’s Note to the 2000 amendment to Rule 702, which was intended to reflect the sensibilities expressed in *Daubert*, states:

If the witness is relying solely or primarily on experience, then the witness must explain how that experience leads to the conclusion reached, why that experience is a sufficient basis for the opinion, and how that experience is reliably applied to the facts. The trial court’s gatekeeping function requires more than simply “taking the expert’s word for it.”<sup>69</sup>

If forensic experts wish to have their testimony admitted on some theory that they have developed “specialized knowledge” by virtue of their experience, it is incumbent on courts to ask them to explain how this was done. Of course, education and training cannot alone buttress their claims, since these sources of knowledge are themselves based on the experience of others. This experience too must be explained. But how might this be done?

Repeated application of the ACE-V method purportedly gives forensic identification experts insights regarding how they reached the conclusion of individualization. But this is not a plausible explanation. First of all, individualization itself is not plausible.<sup>70</sup> While it may be true that every person’s fingerprint is unique, science cannot say, and makes no pretension of being able to say, whether this is true. Moreover, it is entirely irrelevant. The task of latent fingerprint examination does not encompass full prints. No one has ever suggested that particular ridge characteristics are unique. In practice, the problem concerns how likely certain ridge characteristics would be found in a random sample of the population. This is the operative question. Hence, the basic approach forensic identification specialists take is probabilistic, whether they have any appreciation for this fact or not. The correspondence between the marks of trace evidence recovered at the scene and the marks made by the reputed source can only be described in statistical terms. However many details the two have in common, there is some unknown likelihood that another finger, gun, foot or set of teeth was the true source of the latent print, toolmark, footprint, or bite mark.

The only form of currency in which experience might have any value in anecdotal forensics is with the frequencies of the match characteristics. For example, one might plausibly argue that most handgun firing pins are square or rectangular, so that the finding that both the defendant’s gun and the gun used in the crime had a round firing pin is of some

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68. FED. R. EVID. 702.

69. FED. R. EVID. 702 advisory committee’s note (citing *Daubert v. Merrell Dow Pharm., Inc.*, 43 F.3d 1311, 1319 (9th Cir. 1995)).

70. See Michael J. Saks & Jonathan J. Koehler, *The Individualization Fallacy in Forensic Science*, 61 VAND. L. REV. 199, 208–09 (2008).

significance. Saying just how significant (i.e., whether the class size is 1% or 10%) may or may not be within the expert's experience. There may be similar aspects of handwriting identification, such as what percentage of American-born writers cross their sevens. In most cases, however, such experience-based frequency estimates will not be plausible. The average fingerprint expert might be able to estimate the percentage of fingerprints having arch, loop, or whorl patterns (i.e., Level 1 detail),<sup>71</sup> but they are not likely to be able to make any reliable statement regarding the frequency of particular ridge characteristics (i.e., Level 2 detail).<sup>72</sup> Since Level 1 detail is actually not very detailed, this experiential skill set is not much help as a practical matter.

If an expert cannot say how it is that his or her experience "leads to the conclusion reached" (i.e., individualization), then he or she should not be permitted to testify to that conclusion. In fact, in many handwriting cases, this is exactly the sort of "Solomonic compromise" that has been adopted.<sup>73</sup> At least a dozen courts have held that handwriting identification experts can testify to similarities and differences between known and unknown writing samples, but cannot offer an opinion regarding identity of authorship. This basic approach could be extended to all areas of anecdotal forensic expertise.<sup>74</sup>

The Solomonic compromise instituted by some courts, however, is too generous to anecdotal expertise. These cases often allow the expert to go beyond what their experience actually supports. Although they prohibit experts from opining on the ultimate issue of identity, they allow them to comment on the frequency of finding particular dissimilarities or similarities in the population more generally.<sup>75</sup> Under Rule 702, this level of detail should only be permitted if the experts can explain how their experience would give them reliable information about such frequencies.

The fact that there are similarities between evidence and a reputed source has relevance to the trial process, even if it is impossible to say how much relevance it has. Consider, for example, evidence that the

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71. Arch patterns have no delta (i.e., a knot formed by the ridge lines), loops have one delta, and whorls have been characterized by the presence of two deltas. See Oleg S. Avdeychik & Kenneth A. Lagerstrom, *Dispensation of Dermatoglyphic Whorls*, HUMANHAND.COM, Sept. 24, 1999, <http://www.humanhand.com/dispensation.html>.

72. See *supra* note 28 (discussing the three levels of detail involved in the analysis of fingerprint patterns).

73. See D. Michael Risinger, *Handwriting Identification*, in MODERN SCIENTIFIC EVIDENCE, *supra* note 24, § 33:7.

74. Limiting a forensic expert to only describing similarities and differences was the approach that Judge Louis Pollak adopted in his original opinion limiting fingerprint evidence. He later reversed himself and allowed the expert opinion without limitation. See *United States v. Llera Plaza*, 179 F. Supp. 2d 492 (E.D. Pa. 2002), *vacated*, 188 F. Supp. 2d 549 (E.D. Pa. 2002).

75. See Risinger, *supra* note 73, at 406–08 (collecting cases and discussing the problems inherent in permitting experts to testify regarding the frequencies of certain handwriting characteristics).

perpetrator of a burglary in San Francisco drove a red Mustang convertible with a black top. If the defendant owns such a car, this evidence would certainly be admissible, even if no competent evidence was offered regarding how many such cars are on the road. Indeed, if an expert could explain how his or her experience supports such a conclusion—say he or she is a Ford mechanic—the expert might be permitted to say that large numbers of these cars can be found on the roads around San Francisco.<sup>76</sup> Suppose, however, that the suspect car had other “individuating” characteristics, such as a dented front-right fender, a broken left tail light, and an “Impeach Bush” bumper sticker. This level of detail would be highly relevant and surely admissible. The Ford mechanic, however, would probably not be able to make a statement about the frequency of finding cars matching this description in and around San Francisco, since he or she could not explain how his or her experience could support such an opinion. Presumably this number would not be very high, though admittedly higher in San Francisco than in Provo.

Forensic identification experts are in a similar situation to that of the Ford mechanic. The only real difference is that in practice, there would be no need for the Ford mechanic, because the information about the suspect car would be developed through lay testimony. Forensic experts, in contrast, are often needed to either identify the similarities between the suspect and source materials or to shepherd them for the jury’s consideration. For example, in the case of latent fingerprints, experts can display the known and unknown prints side by side and identify the characteristics that correspond between the two. They would not, however—absent some explanation for the basis of their knowledge—be permitted to testify about the likelihood of finding such correspondence in the population at large. And, certainly, they could not make any statement regarding individualization. Of course, common sense tells us, and would tell the jury, that the more correspondence between the suspect and source materials, the more likely that the latter produced the former. But the jury does not need an expert to tell them this.

### CONCLUSION

Many subjects of forensic identification—including, among others, latent fingerprints, firearms, handwriting, and bite marks—have received little or no sustained research attention. They are largely based on anecdotal experience and supposition. Indeed, in many ways, anecdotal forensics resemble other historical failures of science, including, in particular, phrenology. Like phrenology, anecdotal forensics are based

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76. In all likelihood, it must be noted, a judge would exclude such evidence on the basis that most San Francisco jurors would know this fact, and thus the expert’s testimony would be a waste of time.

on inductive experience, have not been subjected to systematic tests, conform to expectations, “prove” what is already presumed to be known, and seem to have great practical utility for society. Moreover, like phrenology, anecdotal forensics employ superficially objective methods to support their subjective judgments. To the untrained eye, and especially the eyes of lawyers and judges, anecdotal forensics look scientific. Phrenologists used highly detailed and specific maps of skulls and the corresponding bumps found on them, and identification experts use methods such as ACE-V. A century from now, however, the anecdotally-based beliefs of forensic experts are likely to survive much as phrenology endures today. They will be no more than abject lessons from the annals of the history of science.

The realization that anecdotal forensics are largely bereft of intellectual content leads to two fundamental questions, both considered in this Article. First, how did this happen and, second, what should be done about it?

The current situation whereby anecdotal forensics are routinely admitted into criminal prosecutions as “scientific evidence” is largely a product of a convergence of ineptitudes. The first lies in the structure and nature of the fields that practice forensic identification science. Outside of only a few exceptions, forensic identification experts are not research scientists. They are primarily affiliated with police laboratories and they merely apply the technologies they were trained to use. They are bureaucrat-technicians who, for the most part, do not have the training in statistics or research methods that would allow them to critically assess the validity of those technologies. Moreover, subjects such as latent fingerprints and handwriting are not studied by mainstream scientists at major research universities. Anecdotal forensics, therefore, possess the patina of science, but there is no scientific community filling in the substance.

Compounding the superficiality of the science, lawyers and judges have little ability to distinguish expert opinion based on the bedrock of high quality research and those based on sand. Most lawyers have little training in the methods of science, and criminal defense lawyers—those charged with examining this testimony in court—often have overwhelming caseloads and undersized budgets. Judges also suffer from lack of scientific sophistication, but they appear further crippled by fear of embarrassment and fear of the consequences if they were to exclude this evidence. Anecdotal forensics have been a mainstay of criminal trials for over a hundred years. Excluding them now would put into doubt many prosecutions and, many courts seem to worry, the mental stability of the presiding judge.

Since it is unlikely that scientists or courts will soon change course, some middle ground must be identified for the continued employment of

forensic experts. Such a course would allow anecdotal experts to testify regarding general similarities and differences found between known fingerprints, bullets, handwriting and teeth, and unknown latent prints, cartridge casings, signatures and bite marks. But such testimony should be limited in that, without supporting data, the expert would be precluded from discussing the frequency or likelihood associated with finding these commonalities (or differences).

This solution is only an interim measure, but could lead to more fundamental and sustained reform. Specifically, anecdotal forensics will only receive the research attention they deserve if mainstream scientists begin to take notice. This will occur only if money becomes available for such research projects. So long as courts maintain the status quo, there is little incentive for government agencies to invest in basic research. Yet courts need not move far for government bureaucrats and policy makers to notice. Of course, even once they do notice, both government and the scientific establishment move at a glacial pace. Like phrenology, then, it might yet take a century to fully see the folly of our forensic ways. But, in the meantime, at least we will be moving in the right direction.